# ENHANCING THE DEVELOPMENT OF COAL USE: ADDRESSING THE ENVIRONMENTAL CHALLENGES

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**ABSTRACT**

Coal has a number of key attributes: it is an abundant, safe, secure, cost-effective energy source that is getting cleaner with the application of modern technology and practices.

Coal supplies over 25% of the total global primary energy demand and around 36% of total world electricity production. Coal has a number of key attributes: it is an abundant, safe, secure, cost-effective energy source that is getting cleaner with the application of modern technology and practices.

But, coal has an image problem to address.

Like other fossil fuels, coal will continue to come under environmental scrutiny and be required to improve its environmental credentials across the full life cycle.

The coal industry must adapt to community expectations at global, national and regional levels. The coal industry must respond not only to mining-related environmental issues, but also to market-related environmental issues associated with the consumption of coal. Adoption of existing clean coal technologies and further advancement in combustion efficiency will be critical if coal is to maintain its position as an integral part of the global energy mix.

Coal will come under increasing pressure to reduce $SO_x$, $NO_x$, $CO_2$ and particulate discharge. Clean coal technologies enhance both the efficiency and the environmental acceptability over the whole coal chain, from coal extraction and preparation through to end-use. Coal is the most carbon intensive of the fossil fuels. But this in fact highlights the opportunities we have to make the greatest improvements over current practice. It reinforces the importance of addressing the efficiency of coal combustion.

Reduced $CO_2$ emissions per unit of energy can be achieved from the application of technology. This remains possible at all levels of coal utilisation worldwide. Many developing countries are able to make the greatest gains. In addition, capture and storage of $CO_2$ is becoming a significant focus for research - and the new front-line in the development of long-term solutions for coal to the requirements to reduce greenhouse gas (GHG) emissions to the atmosphere.

The World Coal Institute shares current concerns about possible climate change caused by human activity through increased production of GHGs and the contribution to this from the combustion of fossil fuels. WCI recognizes this is a global issue involving a wide range of social and economic impacts and supports attempts to achieve a considered - and balanced - global response through cooperative actions. A global problem can only be resolved by a global response involving all countries (but not necessarily in the same way or at the same level) using the most efficient, effective solutions to minimize the overall economic cost.

Coal's future is dependent on a number of factors, including political risk and community acceptance. The objective should be to **promote clean coal technology solutions to combustion efficiency and atmospheric GHG emissions and ensure the community is fully informed about coal and its ability to address the environmental issues.**

## INTRODUCTION

The World Coal Institute is a non-profit, non-governmental association of coal producing and coal consuming enterprises. The Institute has Category II Consultative Status with the United Nations Economic and Social Council and Consultative Status with the United Nations Industrial Development Organisation.

The principal objective of the World Coal Institute is to promote the merits of coal by:

- providing a 'voice' for coal in international debates on energy and the environment;
- improving awareness of coal as the single largest source of fuel for the generation of electricity;
- widening the understanding of the role of metallurgical coal in the worldwide production of steel;
- disseminating information on the advances in modern clean coal technology leading to improved efficiency and environmental performance in mining, preparation, transportation and use of coal;
- highlighting the long-term dependence on coal to meet world energy demand.

## THE CHALLENGE FOR COAL

Coal will continue to come under increased environmental scrutiny and be required to improve its environmental credentials across the full life cycle in all regions of the world.

The coal industry must respond to market-related environmental issues associated with the consumption of coal. There will be increased environmental pressure in respect of $SO_x$, $NO_x$, $CO_2$ and particulate emissions.

Coal must be acceptable in the market place or it will be replaced – a fuel of necessity rather than choice.

## THE REALITY OF CIRCUMSTANCES

The pattern of development is remarkably consistent across all countries, including APEC member economies: income levels and energy demand both rise, to be followed by improving environmental standards.

We should not be surprised that there is an 'affordability index' placed on environmental goals or outcomes by communities and their countries. The first task is to deliver sustained improvements in living standards guaranteeing food, clean water, energy and the removal of poverty. Once progress has been confirmed on these fronts, there is scope to address the other components of sustainable development.

We should also expect to see acceleration in the progression through these stages of development over time. This has clearly occurred in the past – and we can expect this to be reinforced in the future by the growing inter-related global architecture of commerce and environment.

Adoption of clean coal technologies – to enhance both the efficiency and the environmental acceptability over the whole coal chain, from coal extraction and preparation through to end-use – will be critical if coal is to maintain its position as part of the global energy mix.

In a series of reports on air pollution and coal-fired power generation, the IEA Coal Research found that in a number of APEC member economies in the Asian region the emphasis is still on "increasing electric output to satisfy demand and ensure economic growth rather than to safeguard the environment. The situation is however, expected to change and application of clean coal technology on coal-fired power generating facilities is regarded as unavoidable in the beginning of the next century."

## THE SOLUTION

Cleaner coal production and use is available now – it is deliverable. Coal can improve its performance in most countries on all environmental indicators by applying existing technical solutions and emerging innovations. Improvements can be achieved at all stages of the coal cycle.

The technology exists today to address particulate emissions from coal-fired power generation via electrostatic precipitators and/or fabric filters.

Removal of $SO_2$ emissions – a contributor to 'acid' rain – has been addressed by a number of policy and industry changes in many countries, including flue gas desulphurisation (FGD) and different coal specifications. FGD systems are expensive and must be a trade off against the alternatives of low sulphur coals and fluidised bed combustion systems (which do not need FGD systems). FGD can typically add 20% to the capital costs and 10% to the operating costs of a PF coal-fired power plant.

Some countries beyond the APEC region have mandated the fitting/retrofitting of FGD systems to coal-fired power plants – this is not good policy. The sensible policy is to determine appropriate national emission limits – and the sulphur limit for a particular plant and allow the owner/operator to decide how to achieve this target. Fitting of FGD does not guarantee a sulphur emissions outcome nor is it the only solution to achieve reducing $SO_x$ emissions. [The USA uses a cap-and-trade system to achieve its desired sulphur target, leaving market forces to determine the most cost efficient way of achieving the objective.]

Technology has also responded to the need to reduce $NO_x$ emissions from large coal-fired combustion plants. Fitting or retrofitting low $NO_x$ burners, which limit $NO_x$ formation during the combustion of coal is a low cost solution, reducing $NO_x$ output by up to 40%, which meets the required emissions standard in most countries. Improved combustion management will also contribute to reduced $NO_x$ formation in pulverised fuel (PF) plants.

Asia will dominate future demand for coal. This is where some of the most important environmental challenges are to be addressed – and where the most significant gains can be made, in reducing coal's environmental footprint.

On-going significant advances in combustion combined with the greater application of environmental control technology and practices will secure coal's future, as a key supplier of the world's energy needs for the new millennium.

We must seek out areas where the coal industry and the coal consumer are under-performing and look at how we can enhance and promote better outcomes. If we do not encourage change and the timely adoption of modern advances in environmental management we will face a more hostile policy response to the acceptance of coal as a long-term player and partner in both existing and emerging markets throughout the world.

Clearly, there are solutions to the traditional and historic shortcomings from coal combustion. These solutions have been applied with great effect in many countries throughout the world, including Denmark, Finland, Germany, The Netherlands and the APEC member economies of Japan, USA and Australia.

We must encourage the delivery of the improved combustion and environmental performances already available in the market in Japan, USA and other OECD countries to the broader global community as quickly as possible if we are to change community attitudes about coal.

For example, new coal-fired plants, both government and IPP projects, in The Philippines reflect the changed attitude to environmental concerns. The Quezon Power Project (IPP) is one such example. Quezon IPP, located on the island of Luzon in Quezon Province, is a 440 MW base load pulverised coal-fired electric generation facility designed to minimise pollution and safeguard the environment through the use of modern pollution control technology. (The Quezon plant will use

FGD to remove the sulphur oxides from the combustion and an electrostatic precipitator to control particulates.)

Coal combustion products (CCPs), which are produced in coal-fired power stations during the combustion process and also as a result of the desulphurisation of flue gases from power station boilers, are also valuable contributors to an overall improved net emissions performance by the coal industry.

The CCP utilisation options are continually expanding: agricultural applications, mine and quarry reclamation, road construction, cement replacement/enhancement in concrete, gypsum products and in other construction applications. CCPs are used as a replacement for naturally occurring resources and therefore offer environmental benefits by avoiding the need to quarry or mine these resources.

Opportunities for GHG emission reductions from coal use in steel making exist, via recovery and utilisation of gases produced during coke making, and maximising the use of heat/energy created during steel production. Significant energy and emissions credits are available when life cycle accounting is applied to the 'coal to steel' process. The energy input and $CO_2$ emissions of the international steel making industry could be reduced by 25% if the average energy efficiency levels achieved by the EU-15 steel industry were replicated on a global scale. For some APEC member economies, the reduction in energy inputs and $CO_2$ emissions could be halved – but this requires a very significant investment in new plant.

## THE NEW CHALLENGE

The millennium debate for coal is focusing on the most complex of environmental and political issues, the greenhouse effect. The public – and political – concern is that the greenhouse effect is being altered or enhanced due to increased concentrations of GHGs resulting from human activities.

The science of climate change is not absolute and may never be. The World Coal Institute encourages the continuation of scientific research. However, it is now an issue with political implications for industry and trade.

Global GHG emission concerns must be addressed by the coal industry – we must show that the objectives and goals of the international community can be achieved in ways that are least-cost and less detrimental to coal, preserving energy diversity and supporting sustainable development for developing countries.

The Rio Earth Summit in 1992 saw the negotiation of an international agreement drawing a link between GHG emissions and possible climate change (the United Nations Framework Convention on Climate Change – UNFCCC). It received strong international support for its (non-binding) commitments to "stabilize greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic [man-made] interference with the climate system".

The **Kyoto Protocol (1997)** established a legally binding obligation on ratifying Annex B Parties to reduce emissions of GHGs by an average of 5.2% below 1990 levels in the five-year period 2008-2012. [Annex B Parties are the developed countries of the OECD and economies in transition in Eastern Europe and the Former Soviet Union.]

There will be substantial economic impacts and differences across the fossil fuel sectors from the Kyoto Protocol if it is ratified and enters into force. It is also clear that there will be very significant differences for an individual sector, such as coal, across differing countries – and within regions of the same country. These variations are not just a simple split between Annex B and non-Annex B countries, but also depend on the market structure of the coal industry within a particular country.

Kyoto GHG targets will impact on economic growth. How much affect this will have on the global economy and the coal sector will depend on the mix of policies chosen by Parties to achieve their Kyoto target.

Within the Kyoto Protocol there are a number of mechanisms that provide for flexibility in how individual ratifying parties may achieve their targets. If a country ratifies the Protocol, we believe they should have these mechanisms available to them to select an optimal set of policies that minimise the cost of implementation.

While no single model should be taken as the mandatory blueprint, future negotiations should not exclude access to emissions trading, the clean development mechanism (CDM), joint implementation (JI) and sinks.

These policy mechanisms would facilitate achieving the UNFCCC objective that "policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost" and the view of the WGIII to the IPCC Second Assessment Report that "Emission reductions should be carried out where it is cheapest to do so".

Inclusion of clean coal technology projects under the Kyoto Protocol CDM would also open the way for infrastructure projects by foreign countries/companies – and increase the efficiency of the coal sector within non-Annex B Parties such as the People's Republic of China and India (two of the world's top coal consumers). This would mean more energy per tonne of coal consumed, less local pollution – and foreign investors gaining credits for the reduction in emissions. Increasing coal combustion efficiency from 30% to 40% reduces $CO_2$ emissions by 25% for the same amount of electricity.

The World Coal Institute encourages recognition of the benefits from coal efficiency enhancement and coal bed methane projects – and support for coverage of such projects within the Kyoto CDM.

Coal has the capability to continue to supply a major share of the world's energy needs and we have the technology available now to make early, major improvements in the critical areas of efficiency and environmental impacts, particularly in many developing countries.

Coal is the most carbon intensive of the fossil fuels. But, in terms of $CO_2$ emissions (now a major political focus in many countries), this highlights the opportunities we have to make the greatest improvements over current practice. Reduced $CO_2$ emissions per unit of energy can be achieved from the application of technology. It reinforces the importance of addressing the efficiency of coal combustion in developing countries, where the greatest gains can be made. This remains possible at all levels of coal utilisation worldwide.

Competitive energy markets will be required to minimize the adverse impact of the changes – and to create the incentive for technology-based least-cost solutions.

Renewable energy subsidies distort the market and reduce the opportunities for technological change and innovation for other fuel types under any system of GHG targets. Reserving a minimum market share (by government policy fiat) of electricity to be sourced from renewables – a renewables quota – is the most damaging of these subsidy arrangements. Market quotas/shares create a class of suppliers dependent upon government protection – and undermine market efficiency and innovation.

The objective should be to encourage the maximum use of voluntary measures, Kyoto mechanisms and effective market solutions. We must maintain the price competitiveness of coal, promote clean coal ttechnology for combustion efficiency and environmental improvements – and eencourage cost-effective market solutions <u>if</u> Kyoto targets apply, ensuring access to emissions trading, CDM, JI and sinks is not restricted.

Clean coal technologies and improved efficiencies are consistent with the Kyoto objective and can provide significant benefits, in both developed and particularly in developing countries. In order to realise these benefits, access to programmes should not be restricted at the international level. Host countries should determine which projects meet their sustainable development objectives.

**It is important to identify the real goal of the Kyoto Protocol: not to reduce carbon intensity <u>but</u> to reduce GHG emissions. Reducing carbon is only one solution to achieving this goal – and not always the most appropriate or least-cost option for all countries, now or in the future, given the dynamic nature of technological change.**

The GHG debate must also reflect the full life cycle in determining GHG emissions and not just a simple comparison between energy sources at the point of transformation into useable energy. For example, GHG emissions from coal are dominated by the end-use (combustion), whereas natural gas and LNG have a significantly higher level of GHG emissions at other stages of the overall life cycle such as the extraction, production and transmission segments.

## COAL DOES HAVE A POSITIVE FUTURE

The two major uses for coal – steel production and electricity generation – continue to be at the heart of development for most countries seeking economic growth. Coal supplies over 25% of the total global primary energy demand, around 36% of total world electricity production and is an essential input for steel production via the BOF process, which accounts for almost 70% of total world steel production.

Coal is readily available and it is a competitively priced energy source for many developing countries, but this does not mean countries are accepting a substandard environmental outcome.

However, to deliver to the global community the improved combustion and environmental performances already commercially available in many countries will require governments, institutions and industry to work together to produce and replicate the success stories.

Technology transfer and foreign investment is needed. Removal of institutional and commercial barriers will support the early transfer and adoption of clean coal technology.

Most of all, a strong growing economy with improving living standards will speed up deployment of more environment-friendly technology and industrial practices.

Other market impediments should also be addressed as a priority as these could make a substantial – and in some cases a greater – contribution to solving the issue of reducing GHG emissions. Removal of rail transport subsidies and broader adoption of market-based pricing policies in some countries could see a significant reduction in energy demand.

Coal is as clean as the country of consumption can afford it to be – invariably at a level linked to the level of national development and living standards.

Today, one-third of the world's population does not have access to commercial energy. For many, coal will provide the most viable indigenous energy source for the future. Playing to a country's natural attributes – often coal reserves – provides the best opportunity for social and economic – and environmental – improvements.

***It is not the use of coal, but how the coal is used, that must be the focus for action.***

The World Coal Institute appreciates the very significant use currently and the ongoing need for coal to deliver a major component of the energy requirements of many APEC member economies in the Asia-Pacific region (as in other parts of the world). The application of modern clean coal technology at all levels will have a beneficial impact on improving environmental conditions over traditional combustion methods.

Coal consumption in Asia-Pacific (excluding the People's Republic of China and India) grew by 24% in the decade to 1999, with most of this growth (19.5%) in the last five years. The share of coal in primary energy for the Asia-Pacific (excluding People's Republic of China and India) continues to be 20%.

Coal has the capability to continue to supply a major share of the world's energy needs. The technology is available now to make major improvements in the critical areas of efficiency and environmental impacts.

We have solutions to the problems of high particulate emissions and to acid rain from coal combustion – here the issue is competing demands or priorities for scarce financial resources and the policy/commercial architecture to enhance and promote delivery and full implementation.

Technology can and will deliver solutions – significant public and private research is now focussed on the challenges of tomorrow. The US Vision 21 and the European "technology tomorrow" projects have the objective of researching the next generation coal technology to deliver efficiency in the order of 55%-65%, resulting in further emission reductions. Significant research effort is now being focussed on the capture and storage of $CO_2$ with the objective of delivering energy from coal under "net zero emissions to atmosphere" conditions in the future.

Coal must also recognise the emerging opportunities for strategic alliances with other energy sources to deliver effective solutions to a wide range of issues – both economic and environmental. We already have examples of coal now combining with renewable energy sources to supply power generation solutions, such as the biogases-coal partnerships in power plants in Mauritius, Guadeloupe and Réunion Island.

We will also see 'next generation' energy partnership projects combining coal and sewerage sludge to solve emerging waste disposal issues combined with energy supply.

Clean must be recognised as a dynamic factor in the future coal demand function, rather than a static component.

We have to work the environmental issues in partnership: coal producers and coal consumers and governments and the community. We must deliver the message that coal is – and will remain – a responsible part of the energy and industry sectors.

The coal industry will continue to increase its focus on those issues of interest and concern to the global community.

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***The World Coal Institute works to promote the use of coal and is the voice for 'coal' in international debates on energy and the environment. For further details on the Institute and its activities, please visit the WCI website at:*** **http://www.wci-coal.com**

World Coal Institute publications to be distributed to all delegates:

1. "Reducing Anthropogenic Greenhouse Gas Emissions to Atmosphere A Positive Role for Coal" (World Coal Institute promotional leaflet highlighting opportunities available for coal to reduce its greenhouse/environmental footprint).

2. World Coal Institute "Coal – Power for Progress" (Fourth Edition, March 2000).